



The Arboretum Bulletin



VOL. III. No. 4.

SEATTLE, WASHINGTON

APRIL, 1940

Garden Soils

By JOHN H. HANLEY

ALTHOUGH the rise in popularity of the use of culture solutions or nutrient solutions in the field of professional and amateur plant growing might seem to have cast a somewhat different light upon the whole problem of using the soil as a growth medium, and particularly upon the value and use of fertilizer materials on soils, the fundamental concepts of soil utility and soil handling remain the same. In some cases they have even been strengthened. On the basis of the apparently successful use of nutrient solutions, one might be disposed to assign to chemical fertilization a position of too great importance. To be sure one cannot neglect the chemical phase of soil fertility. An examination of those elements which are essential to the growth of plants reveals the relative importance of the soil as a source of the majority of them.

There are ten elements which are placed in the truly essential category. They are carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, iron and magnesium. In addition to these it has been found, under certain conditions and with certain types of plants, that other elements may be necessary for good growth. These are aluminum, silicon, chlorine, copper, boron, sodium and manganese.

Of these elements carbon comes to the plant from the air, although the concentration of it in the air is maintained through the break-down of organic materials (plant and animal remains) in the soil; hydrogen finds its source principally in the soil water; and oxygen enters the plant by direct diffusion from the air as well as being carried into the plant tissues in chemical combination with carbon and hydrogen as either carbon dioxide or water. The remainder of the rather long list of essential elements have their sole origin in the soil. Thus we can readily appreciate the importance of the chemical content of the soil when it is used as a growing medium.

But, oddly enough, it is not sufficient to look only to the chemical side of the soil. Its physical qualities are of equal importance. The physical character, the soil's texture, is much the more neglected phase probably because its relation to the successful culture of plants is not as easily understood or possibly because it is often the more laborious and expensive task.

It is important to have soil in the proper condition. There are several reasons for this. Soil texture can influence the availability of the needed chemicals to the plants. The plants can make more efficient use of the chemicals which are added in fertilizers if the soil is loose and friable. Smaller quantities of these elements become "fixed" and unavailable if the soil is in good condition. The very small particles of which clay soils are composed are able to asso-

ciate themselves intimately with the chemicals in a fertilizer and hold back the needed elements from the plant.

There is also the very important matter of an adequate oxygen supply. Oxygen is as essential to plant roots as to any other part. A loose soil permits easy penetration of adequate amounts of oxygen to the living roots. Oxygen also tends to neutralize and render ineffective many toxic substances which may be produced in soils, such products as may come from only partial breakdown of organic material in the soil.

A loose, friable soil also permits easier penetration of the roots as they branch and grow beneath the surface.

The chemical deficiencies in a soil can be corrected with relative ease. There are on the market today any number of reliable fertilizers which will supply in adequate amounts those elements which are most often lacking. The average commercial fertilizer is a "complete" one, that is, it contains nitrogen, phosphorus, and potassium (N. P. K.) in varying percentages of concentration. Lacking information on the actual concentration of these three elements in a garden soil, it is wise to make use of a fertilizer containing all of them, a "complete" fertilizer. If it is possible, the gardener should have the soil tested periodically. Soil tests are designed to show the concentration of the various elements that is actually available to plants. Oftentimes a garden soil will be lacking in only one, or perhaps two, of them. To add a complete fertilizer under such circumstances would be inefficient and might even reduce the growth of the plants. A plant can be injured by overdoses of fertilizer elements just as it can be retarded by deficiencies. A soil test will show wherein lie both deficiencies and sufficiencies.

The physical quality of a soil can be altered—should be altered—if it is not right. In changing it one may make use of substances which are really fertilizers, principally organic fertilizers. Well-rotted cow manure is a fertilizer to the extent that it adds small amounts of available nitrogen, phosphorus and potassium. But it has other effects that are just as important. It adds to the bacterial content of the soil; it provides organic material that can be broken down to give available nitrogen; it makes a soil more friable and easier to work; plant roots can penetrate more easily; and it increases aeration. All of these things are very important and all of them contribute to that sum total of factors that are implied when we say "a good garden soil." Other organic materials have similar effects although they do not ordinarily contribute so completely to the correction of so many of the soil qualities. Peat, leaf mold, and compost material all are good for this purpose.

An interesting thing has been brought to light in recent years through comprehensive fertilizer experiments. It has been demonstrated that the way in which the fertilizers are applied has a direct bearing upon their effectiveness.

Broadcasting was shown to be distinctly inferior to other methods which required placing the fertilizers in rows or rings along side of or around the plants. There are several reasons for the effectiveness of this system. One of the principal ones lies in the fact that fertilizing materials placed in this way are more available to plant roots because a smaller proportion of the nutritive substances are "fixed" by the soil particles.

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Terrestrial Orchids

By GLADYS FRANCE BAKER

WHEN I first came over east of the lake I planned to naturalize many flowers in my woods. With a good many I succeeded but not with terrestrial orchids. My soil is light and dry, moles run in from the adjoining places, and then in the third summer came an army of slugs, big black ones like baby seals, and mowed down my orchids in a single night. So I began growing them in tubs, sunk in the ground, which controls moisture, baffles moles, and slug bait just outside the tub helps with the slugs. The amount of moisture in the tubs can be controlled by the position of drainage holes; some are up to three inches on the side and some are in the bottom and a good deal of peat is used in the soil make-up. Last year I planted three varieties in a bog built in a huge old cedar stump. It is too soon to be sure how well these will succeed but I hope for the best. In my tub gardens I have grown with complete success *Cypripediums* *acale*, *montanum*, *parviflorum*, *pubescens* and *Reginae*, and failed with *fasciculatum* which got too dry, but I mean to try that one again.

I have also grown in tubs several *Habenarias*, *eilii*, *fimbriata* and *psychodes* and have colonies of *Epipactis* here and there, in dry ground. *Calypso* I have not done so well with; nobody has, although the ground hereabouts used to be purple with them. I am convinced that we have introduced too many enemies for them to survive. I had quite a colony established at one time, which included a rare white flowered one, but after they had bloomed the third year the Chinese pheasants ate them. Pheasants are very poor gardeners. The *Calypso's* habit of sending up its leaf in the autumn invites insects, slugs, etc., that their ancestors never had to contend with. I am going to try them again under a sand screen cover with slug bait for a border and shall be glad to report later if I succeed.

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Pruning of Trees and Shrubs

By HERBERT PRUVEY

SHOULD we ramble through the woods at any time of the year, one of the facts in evidence, if we observe closely, is that on the tall evergreen trees, no green shoots are apparent for almost one-half the height of the tree. Should the same kind of tree be observed on the outside of the wood, it will readily be noticed that it is clothed to the ground in luxuriant foliage.

If we look closely at some of the deciduous trees, such as *Acer macrophyllum*, we see that the most vigorous shoots and largest leaves are situated where each shoot and leaf obtains a maximum of light and that the small leaves and weak, thin wood is where there is a lack of light. Often we will find these inner branches or twigs are dead and as such are a resting place for fungous diseases and insect pests. A further study of this reveals that shrubs are affected in the same way, the dead weak and thin wood in most cases, being where there is a lack of light.

The lesson taught us then, is that nature prunes its own trees and I know of no tree or shrub where this is so evident as in *Diospyros*, the Persimmon. So it is that we find that pruning our own trees or shrubs will give us more vigorous shoots, finer foliage and larger flowers.

A very important factor in pruning is the selection of the proper time of year to do it. This is governed by the type of plant we desire to prune. Broadly speaking, there are two periods during the year when pruning can be done. Plants such as the *Syringa*, some *Viburnums*, *Choisya*, *Wistaria*, *Paeonia*, *Moutan*, some *Jasminums*, *Forsythia*, *Exochorda* and even *Rhododendron*, or the *Lilac*. We observe that each vigorous shoot is terminated by a very stout bud. If we look closely and well into the plant, we may observe 1 or 2 weak shoots (due to lack of light) which, instead of being terminated by a stout bud have a small thin bud at the apex. The stout buds hold the embryonic flowers that will develop and furnish the floral display for the next season and the small, thin bud contains leaves only. If it is too weak or stands too far back in the crown, the chances are that it will be killed before next year by lack of light.

Should we prune these plants in winter, with every cut we remove a part of our next display. Moreover, there is no time left for the growth to terminate and develop a stout flower bud for these are formed by the end of July the previous season. But should we prune soon after the flower is dead, each strong shoot that springs from below the cut will be terminated at the apex by a stout floral bud in the fall.

There is another group of plants that requires an entirely different time of pruning—those that flower in the summer and fall or after the end of June. Into this class come *Hibiscus*, *Hydrangea* *otaksa* and *paniculata grandiflora*, *Diervilla*, *Abelia*, *Buddleia*, *Ceanothus*, *Colutea*, *Calliarpas* and others.

In pruning the first type, those that flower in the spring, any dead wood should be entirely cut out. The next step is to remove any branches or twigs that crisscross with other branches or twigs, preferably taking out the one that runs inward; these should also be entirely removed. The plant that now remains has all of the shoots pointing upward and outward. Moreover, they are all fairly strong and vigorous. Now start to shape the tree by cutting back $\frac{1}{3}$ to $\frac{1}{2}$ of the strong vigorous shoots, leaving the leader till last. In pruning this leader, it is well to remember that sometimes it will persist in growing widely out from the axis of the trunk. Especially in fruit trees does this occur. This can be rectified by pruning to a healthy bud pointing in the desired direction. At first this would appear to produce a main axis from the trunk as though it were zigzagging, but in time it will straighten up.

In the pruning of the summer and fall flowering types that are pruned from January through March, the first thing to do is to cut out the dead, weak and thin wood entirely. This then leaves our shrubs with many ascending shoots or branches which sometimes curve downward or outward at the ends. If we observe these shoots that are left, we notice some appear to be a much darker color in the bark; in some cases it is almost black, while in other cases shoots that are just as strong appear a light brown. If the plant is a good-sized specimen with lots of light brown wood, the dark or blackish branches should be cut out entirely to the ground. This will result in strong vigorous young wood arising from the growth buds that are just below the ground line at the base of the old wood. It is from the young vig-

orous wood of 1-2 years old that we secure our largest and finest flowers. In the case of hydrangeas and some other plants, these strong light colored shoots are then shortened back $\frac{1}{3}$ or $\frac{1}{2}$; in other cases, as with some spiraeas, these strong young shoots are left and will produce flowers over practically their whole length.

It is well to remember in pruning that the natural form is best, and that unless a subject is a formal one in a formal setting, such as dwarf box, that shearing should be abolished, for it eventually becomes so thick from repeated shearings that the natural form is entirely lost.

Another grief often met with is the planting of Evergreens such as *Cupressus lawsoniana allumi*, or *crecta viridis*, and related plants right below the windows. They are put in when they are small, their green and bluish foliage being their selling point. Eventually they grow up in front of the window and obstruct the light within and are always thereafter, quite a nuisance. If plants with a smaller stature were planted in these positions, such as *Juniperus Sabina tamariscifolia*, *J. adpressa* or some of the dwarf *Chamaecyparis* or even *Aucuba japonica*, this trouble would be obliterated.

In some countries, shrubs are planted for the bark effects in winter. Such things as *Cornus stolonifera* and its yellow form, *C. flavimarca*, *C. vitellina* or *Corchorus japonica* are particularly good. It is well to remember in pruning these, that the young wood assumes the brightest color in the winter, hence there should be a liberal cutting-out of the 2-, 3- and 4-year-old wood to the ground line.

In some cases, as in large plantings of *Tamarix* or *Salix*, alternate plants are cut 4 to 6 inches from the ground in alternate years. There is also a class of shrubs that require little or no pruning whatever. *Andromeda* (*Pieris*) *floribunda*, *Skimmia japonica*, *Kalmia latifolia* and *Daphne* are examples of this group.

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Genetic Strains of Douglas Fir

By J. H. HANLEY

THE Douglas fir, *pseudotsuga taxifolia*, has greater ornamental possibilities than most of us realize. A plausible explanation of our unawareness undoubtedly lies in the fact that the opportunity for studying the trees, under conditions where each individual has ample space for developing its typical characteristics, is not often provided.

The Tacoma prairie area, which is gradually being invaded by the Douglas fir, is an excellent place to observe individual variation among seedling trees. Each plant has plenty of room to display the varying characters upon which landscape value depends. Under the highly competitive conditions found in the forest the variant races are largely obscured; trees grow too close, light intensity is very much reduced, crowns are relatively small and variations in growth habits are difficult to recognize. On the prairie area mentioned, however, the trees tend to be full-crowned with living branches sweeping to the ground in most cases. Under such conditions the difference in growth habits can be readily recognized and the value of the individuals for ornamental purposes can be judged more easily.

Our work in selecting the outstanding strains has really just begun. The problem is being attacked from several angles other than the strictly ornamental one. Thus far ten strains have been selected. In making the selections the

habit of growth, the foliage color, the propensity for natural pruning, and the seed viability have been the principal characters used.

So far as habit of growth is concerned it is not difficult to find many variations. These variations run from an extremely pendulous form with a corkscrew trunk (the branches bend down almost vertically and lie along the trunk), through several intermediate grades which display varying degrees of pendulousness, to semi-erect, erect and near-fastigate types. The extreme forms are of course the most interesting. One particular tree with twisted, gnarled trunk and very pendulous branches is outstanding. It departs so far from the normal that it is improbable that one who has not seen it close at hand would recognize it as being a Douglas fir from even a short distance.

The other extreme type, erect-fastigate, is not well represented in our collection as yet, although a form closely approaching it has been found and is being propagated. This particular tree is a beautiful specimen. The branchlets are ascending, stiffly rigid, and clothed with short, stiff, radially-spreading needles. The crown is rounded, full, and bushy, forty feet tall and almost as broad—a thoroughly magnificent tree, lacking entirely the characteristic looseness of crown of the type and showing very little tendency toward the usual two-ranked arrangement of the needles.

Although the variations in growth habit are the most interesting, selections have also been made on the basis of foliage color. Color, of course, is more easily affected by local variations in soil conditions. The chances of locating individual trees in which foliage color is genetically determined is therefore somewhat more difficult. In making these selections trees of the same approximate age and height, growing near each other, under what appeared to be very similar site conditions, were chosen. Yellow-green, bright green, and blue-green variants were chosen and are being propagated vegetatively. We are still looking for a very yellow and a very blue form.

The above comment on the possible effect of slight soil differences on foliage color brings up another advantage to be found on the Tacoma prairie. The prairie terrain is rather ideal for a study of this kind. Abrupt and severe changes in elevation and soil type are at a minimum. Soil samples taken over wide areas were tested for p^h , nitrates, phosphorus, potassium, and colloidal content. Variations were found to be in a definitely narrow range, thus serving as another indication that soil and site conditions in this prairie area probably affect the growth variations of the trees to a minimum degree.

The other characters that are being observed, propensity for natural pruning and seed viability, relate to the selection of strains for lumber purposes. Thus far we have no direct evidence that there are strains which show different abilities to prune themselves naturally. There are merely indications that point to certain possibilities along this line. The object of selections made on this basis would be to develop strains which would produce clearer, hence higher grade, lumber. So far as seed viability is concerned, germination tests have disclosed that seeds collected from certain parent trees gives markedly better germination than others. This again is more closely allied to commerce than to landscaping and it indicates the desirability, on the part of governmental agencies in particular, to make more careful selection of parent trees when seed is being collected. Of course the next step in this direction is to discover which trees produce the most vigorous seedlings. This test follows naturally with the experiments on seed viability.



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Arboretum Foundation, 4420 White Building
SEATTLE

Published by the

THE ARBORETUM BULLETIN

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